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G7 countries – advocates of the global business cycle

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Abstract

In the new global framework, the concept of business cycle synchronization has become a central research issue, in order to better explain the interdependencies, co-movements and exceptional behaviors among the national economies. The aim of this research paper is to assess business cycles' synchronization within the G7, emphasizing the role of the trade channel as a transmission vector. Annual growth rates for GDP and trade were filtered using the Hodrick-Prescott method and the results were correlated through the Pearson approach to obtain the degree of similarity between countries with respect to their economic fluctuations. The results highlight a stronger degree of synchronization during recessions, while in time of economic expansion there are 2 well-defined macro cycles corresponding to each continent: Europe, North America and the emergent Asian cycle. Furthermore, trade was proven to be an important business cycle vector just for some countries, while for the completeness of the study additional variables should be also taken into consideration.

The significance of this study resides in the highlighting of the business cycle synchronization by means of the trade channel for the most influential economic powers of the world. This work can be transformed into a cybernetic model of the business cycle and, most of all it can offer solutions regarding the propagation of the crisis.

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1. Introduction

Two of the most significant and debated topics within the international economics field have been, in the last

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decades, globalization and business cycle synchronization, and also, derived from this, the linkages between them.

In the new global framework, the concept of business cycle synchronization has become a central research issue, in order to better explain the interdependencies, co-movements and exceptional behaviours among the national economies.

The present study seeks to address the following questions:"*Are there pieces of evidence regarding the synchronization of business cycles between the G7 countries?*", and if this is proved to be true,"*Can these seven countries be considered the promoters of economic globalization*?"

The motivation for choosing the G7 as the analysis group resides in the fact that they are considered the most developed economies in the world, and also the fact that the international literature presents somewhat of a knowledge gap as regards to the idea that the G7 states are the only main advocates of economic globalization.

The study will employ a Hodrick-Prescott filter on a set of variables and will cover a time span of 41 years, from 1970 to 2011, thus including several business cycles and providing a comprising historically motivated result.

The remaining part of the article is structured as follows. Section 2 presents the previous literature landmarks, Section 3 displays the data and the methodology employed in the study, while Section 4 comprises the results provided by the analysis and their discussion. The last part of the article offers the authors' conclusions.

2. Literature review

In the last two or three decades the emphasis put on the process of economic globalization has shifted the analysis' focus towards an international level. The framework proposed by globalization targets the interconnections, interdependencies and co-movements between national economies, in order to better explain the structural transformation that have occurred in the global economy.

The concept of business cycles synchronization can no longer be studied at a national level. The international literature has focused mainly on analyzing the GDP, either as an absolute variable, or as a growth rate (Krolzig, 2003), (Li and Liu, 2004) and its connections with macroeconomic variables such as trade, proposed by the pioneering work of Frankel and Rose (1998), which was further developed by Imbs (2004), who advocate the important role of the trade channel. Other papers have focused on regional synchronization of business cycles such as the European Union (Artis, 2003; Darvas and Szapary, 2004), while others explore an enlarged sample, taking into consideration OECD (De Haan, et al., 2008), or the global context (Kose, et al., 2008).

Some of the studies mentioned above emphasize the role of the commercial channel, by using concepts such as bilateral commercial movements, trade intensity and trade openness, while other papers have stated that trade has a moderate effect on business cycles synchronization, contrary to the one brought forward by the financial channel.

The exclusive group of the G7 countries has been analyzed by a number of studies (Chauvet and Yu, 2006), focusing either on the volatility of the economic activity (Stock and Watson, 2005), the existence of a significant world cycles that encapsulates the trend dictated by the G7 (Canova, et al., 2007), or the asymmetric effects brought by the international oil shocks from the last decades (Cologni and Manera, 2009).

Canova et al. (2007) underline the existence of a noteworthy world business cycle given the fact that "the aggregate indicator used in the study accounted for an important part of the international fluctuations" within the G7 countries. What is more, the author states that there is little evidence to support the idea that the Euro cycle is somewhat different from the general global cycle. This contradicts the findings of Stock and Watson (2005) and others, who emphasize the perception of a cyclically coherent group consisting of the Euro-zone countries (Germany, France and Italy) and that the United Kingdom is more synchronized with the United States and Canada, then with its neighbouring European states.

All of the three studies previously mentioned (Stock & Watson, 2005; Canova, et al., 2007; Cologni and Manera, 2009) have underlined the exceptional situation of Japan, which became, since the 1980s, detached from the G7 unit and more synchronized with the Asian economies, mainly due to the strong trade links.

As a general remark, the international literature considers that the complex process of economic globalization should bring a higher degree of business cycles synchronization between the developed economies, due to the increased activity of the commercial and FDI channels (Otto, et al., 2001; Fidrmuc and Korhonend, 2010; Artis and Okubo, 2009; Enea and Palaşcă, 2012).

3. Empirical approach

3.1. Sample

This paper is concerned with the members of the G7 group, namely the U.S., U.K., France, Germany, Italy, Canada and Japan, to which China is added as the eight economic power of the world.

In order to assess the synchronization of the business cycles, we employ a bifactorial analysis, including both the aggregate indicator GDP expressed by the annual growth rate, as retrieved from the World Bank database, and one of the determining factors of business cycle transmission, namely exports and imports expressed as a GDP percentages, also retrieved from Word Bank (World Bank, 2013).

A composite variable accounting for trade was computed for each country, *i* and each year, *t*:

$$trade_t^i = export_t^i + imports_t^i$$

Trade is also expressed as an annual growth rate, in order to be comparable to the GDP growth rate:

$$trade_t^i\% = \frac{\left(trade_{t-1}^i - trade_t^i\right)}{trade_t^i} \cdot 100$$

The time span investigated was 1970 until 2010, in order to include several complete business cycles (Juglar cycles) as described by the Burns and Mitchell (1946) methodology.

3.2. Methodology

The goal of this study is to assess the co-movements of the G7 countries' business cycles.

This endeavour has been undertaken by academics by means of various techniques, such as Bayesian models (Marley and Piger, 2010), dynamic correlations (Fidrmuc, et al., 2012), cluster analysis (Camacho, et al., 2006), parametric models (Stock and Watson, 2005) and Markov switch models (Bruno and Otranto, 2004).

A different approach is that suggested by Canova (1994; 1998), who advocates for the separation of time series components, namely the trend and the cyclical component by means of filters. The literature presents an array of filtering methods, out of which, the most widely used is the Hodrick – Prescott (1997) filter, or the band-pass filters such as the Baxter-King filter (1999), and the Christiano-Fitzgerald filter (2003).

Widely discussed, (Cogley and Nason, 1995; Harvey and Jaeger, 1993), the HP filter is still accepted as a milestone for the business cycles' study of and is employed for the assessment of patterns displayed by a variety of time series.

The HP methodology implies that the time series y_t is composed of a trend g_t and a cyclical part c_t, hence: $y_t = g_t + c_t$.

The method proposed by Hodrick and Prescott is to segregate the cyclical element c_t by the following minimisation problem:

$$\min_{\{g_t\}_{t=1}^T} \left\{ \sum_{t=1}^{T} c_t^2 + \lambda \sum_{t=1}^{T} \left[(g_t - g_{t-1}) - (g_{t-1} - g_{t-2}) \right]^2 \right\}$$

The logic behind this can be considered a generalization of the least squares method, the only distinction consists of the parameter $\lambda > 0$, used to smooth out the variance of the series around the trend.

The parameter λ is highly dependent on the regularity of the analyzed data, in relation to the volatility of the time series y_t. For annual data, a low value (under 100) is recommended (Baxter & King, 1999). Nilsson and Gyomai (2011) recommend that $\lambda = 7.02$ for annual observations, while Ravn and Uhling (2002) previously advised that

$\lambda = 6.25$ is suitable for yearly records.

Eviews 7.1 allows the user to select the appropriate value for λ, thus, there is no difference for annual data between the previously discussed values for λ, thus $\lambda = 7$ is considered suitable.

The purpose of choosing the HP filter over to the afore-mentioned, alternative, methods is twofold. Firstly, the HP filter is frequency sensitive, a feature necessary to evaluate the data sets according to their nature; secondly the HP filter has been statistically confirmed superior to the band-pass filter and phase-average trend methods as shown in the paper of Canova (1994), and that of Nilsson and Gyomai (2011).

This analysis does not suffer from the common downsides of using the HP filter because the analysis is concerned only with past data and the domain of the series closed, namely the filter is not to make predictions, it is used only exploited to indentify the cycles in historical data.

Using the HP filter we have computed the cyclical components for the entire sample of countries, including both GDP and trade variables.

- Cyclical component of GDP for all countries in order to asses business cycle synchronization through the aggregate indicator;
- Cyclical component of trade for all countries with the purpose to estimate business cycle synchronization via the commercial channel which is known in the literature as one of the main diffusion channels;
- Cyclical component of GDP and Cyclical component of trade for the same country so as to show the importance of trade in the respective country's GDP, as a confirmation of the results obtained at the previous calculation.

4. Results and discussion

The application of the HP filter on the growth rates of the GDP revealed the results comprised in Figure 1 and Figure 2, which are consistent with previous findings in the literature namely that within the G7 group there are 2 distinct sub-groups, the European mainland group and the Anglo-Saxon group (Stock and Watson, 2005).

In addition, Japan has a slightly different business cycle pattern (Stock and Watson, 2005), which only converges during notable recessions, while China experiences a completely divergent business cycle pattern from the G7 group.

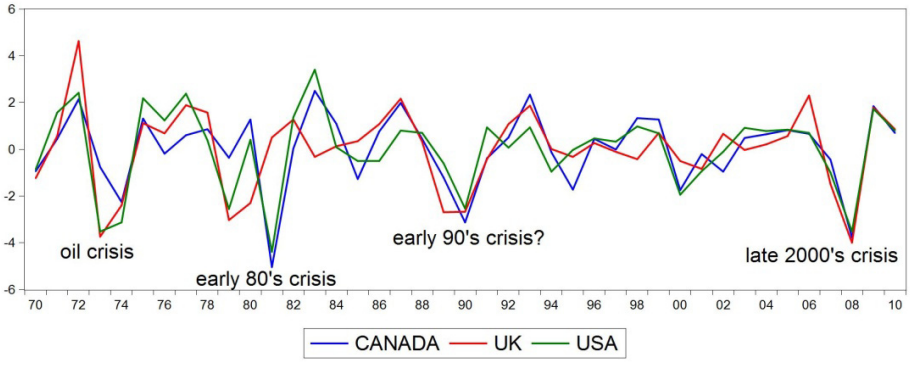

Figure 1- The Anglo-Saxon group synchronization

These results are emphasized even more by the Pearson correlation coefficients provided in **Error! Reference source not found.**.

The European mainland group, including Germany, France and Italy has highly positive (75-85%) correlation coefficients, which are due to a series of factors such as: the status of founding members of the European Union, common economic and financial policies, and geographical proximity.

Table 1. Pearson correlation coefficients between cyclical components GDP

	CAN	FRA	GER	ITA	JAP	UK	USA	CHI
CAN	1.00	0.52	0.54	0.61	0.46	0.56	0.82	0.18
FRA	0.52	1.00	0.75	0.85	0.42	0.60	0.51	-0.09
GER	0.54	0.75	1.00	0.81	0.68	0.50	0.60	-0.08
ITA	0.61	0.85	0.81	1.00	0.47	0.52	0.51	-0.16
JAP	0.46	0.42	0.68	0.47	1.00	0.61	0.57	0.16
UK	0.56	0.60	0.50	0.52	0.61	1.00	0.68	0.36
USA	0.82	0.51	0.60	0.51	0.57	0.68	1.00	0.18
CHI	0.18	-0.09	-0.08	-0.16	0.16	0.36	0.18	1.00

Only the synchronization between Italy and Germany is supported by the idea that trade is a business cycle transmission channel due to the 91% correlation found in Table 2, the other states having lower correlations regarding this index, thus promoting the idea that other channels may also be important, such as foreign direct investments (Li and Liu, 2004; Enea and Palașcă, 2012) or portfolio investments.

Table 2. Pearson correlation coefficients between cyclical components trade

	CAN	FRA	GER	ITA	JAP	UK	USA	CHI
CAN	1.00	0.55	0.51	0.41	0.58	0.43	0.46	0.74
FRA	0.55	1.00	0.38	0.29	0.43	0.31	0.27	0.62
GER	0.51	0.38	1.00	0.91	0.85	0.83	0.73	0.78
ITA	0.41	0.29	0.91	1.00	0.77	0.83	0.56	0.70
JAP	0.58	0.43	0.85	0.77	1.00	0.71	0.70	0.70
UK	0.43	0.31	0.83	0.83	0.71	1.00	0.63	0.76
USA	0.46	0.27	0.73	0.56	0.70	0.63	1.00	0.62
CHI	0.74	0.62	0.78	0.70	0.70	0.76	0.62	1.00

The second figure reinforces Artis' (2003) vision on the European countries which tend to be more synchronized in recessions than in expansions.

The UK, although a European country, shares more similarities with the other Anglo-Saxon countries and even with the Asian countries, as a legacy of old commercial links. The results (Table 1) show that the highest synchronization is attained between the UK and the US through the mercantile channel.

Trade also accounts for the synchronization between the UK and the Asian powers: China experiences a correlation of 36% via GDP but this result is highly influenced by trade (76%), a situation analogous with that of Japan.

The northern American countries (US and Canada) share a high degree of synchronization (82%) mainly due to geographical proximity and notable trading links (46%) within the NAFTA agreement.

A noteworthy situation is that of Japan, which has a very different business cycle outline from all the other G7 countries. A graphical representation thereof can be seen in Figure 3, which includes a comparison between the most important economic powers from each continent: USA, Germany and Japan, a choice dictated by the results (Table 1), which show that the Nippon country experiences the highest degrees of business cycle synchronization (68% with Germany and 57% with the US) with these partners from the G7 group. This result is highly due to Japan's trade openness and business relations specifically with these countries as it can be inferred from Table 2.

In contrast with the expansion periods, when Japan suffers only mild fluctuations, which are uncorrelated with the other G7 countries (Stock and Watson, 2005) during recessions, this country is prone to severe downfalls as the oil and late 2000's crisis show, especially due to one of the country's positive economic features, namely the trade openness (Kawai and Takagi, 2009).

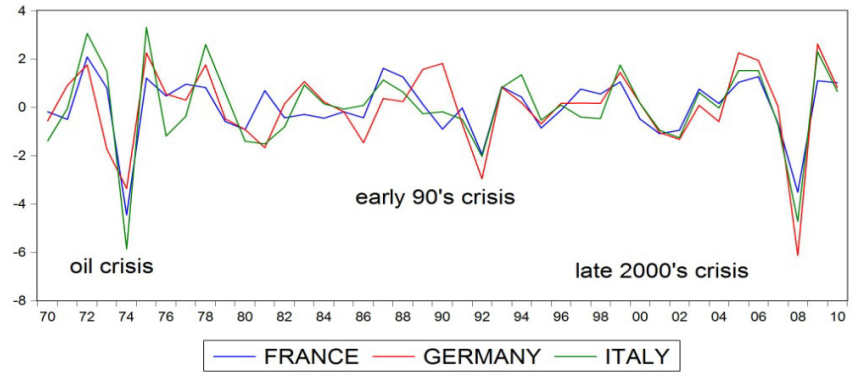

Figure 2-The European mainland group synchronization

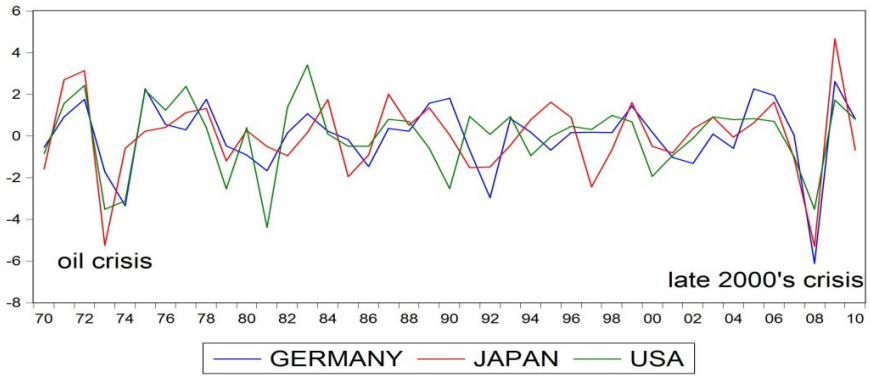

Figure 3- Germany, USA, Japan

These findings further support the idea that there are several business cycles within the G7, to be precise, an European business cycle which is dictated by the mainland core countries, an American business cycle which also includes the UK due to linguistic and cultural similarities and a possible emerging Asian business cycle, which is still unclear due to the divergent patterns of the main powers, China and Japan.

Nevertheless, there is important statistical evidence of business cycles' synchronization, but this feature is more noticeable during recessions or even crisis and becomes diluted in expansions, when each country's idiosyncratic features subjugate the common component.

5. Conclusions and limitations

The present paper has investigated the role played by the G7 in the international economy, portrayed as the main vector of the globalization process. In addition to this, the study has highlighted the fact the countries that form this exclusive group represent the core of global business cycle, being considered the economies that dictate the general trend in the international economy.

The main purpose of the research was to assess the business cycle synchronization patterns inside the G7, in order to better grasp the transformations which can occur between periods of economic expansion or recession. What is more, the study has emphasized the role of the commercial channel within the business cycle transmission

mechanism.

The study has showed that, in general, the G7 group cannot be considered homogenous. One of the more important findings that emerge from the research is fact that the G7 encapsulates three macro business cycles, namely the Euro-zone cycle (Germany, France and Italy), the English-speaking cycle (U.S.A., Canada and the United Kingdom) and the Asian cycle (Japan and China). The second major finding is that trade has been found to be an important business cycle transmission channel, especially in Europe, where we can highlight the cases of Germany and Italy, previously discussed, and also for the US in its relationship with Canada. It can also be said that during times of recession, the G7 countries have displayed similar synchronization patterns.

The results of the research suggest that, during periods of economic expansion, each can country can rely on its own national attributes to develop and increase the degree of synchronization. Also the study has underlined the fact that the occurrence of a recession in one country can represent a warning signal for the other, in order to develop and implement anti-recession policies. These policies can become more effective if they take into consideration the transmission lag.

The preset study has proved the unquestionable existence of a Euro-zone cycle, centred around Germany, France and Italy, and has highlighted Japan's unique position and behaviour within G7. In addition, it has restated the importance of the trade channel as a transmission vector of business cycle synchronization.

The limitations of the research derive from the size of the sample, the few indicators used in the analysis, and also the use of annual date. Therefore, the future directions of study will aim to enlarge the sample and employ, if possible, quarterly data.

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